Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

42c
R31

August 1958

ARS-33-49

Cop. 1

OBSERVATIONS ON THE BIOLOGY OF THE IMPORTED FIRE ANT

U. S. DEPARTMENT OF AGRICULTURE
LIBRARY
OCT 13 1958
BELTSV

Agricultural Research Service
United States Department of Agriculture

Foreword

From 1949 to 1953 research on the imported fire ant was conducted by the U. S. Department of Agriculture in cooperation with the State of Alabama's Department of Agriculture and Industries, Department of Conservation, Agricultural Experiment Station, and Extension Service. The Mississippi Fish and Wildlife Service and the Mississippi and Florida Agricultural Experiment Stations assisted in these studies. During the course of this research, which was primarily for the purpose of developing methods of control, considerable information was obtained on the biology of this ant. This report summarizes the biological observations.

Methods for the control of this ant in individual mounds and in small areas were published in Leaflet 350, The Imported Fire Ant, How to Control It, in 1954. This leaflet also gives some general information on its biology, but most of the biological data obtained by Department and State entomologists have not been published. The continued spread of the ant and the efforts of Federal and State agencies to eradicate the pest have increased the need for such information. That given in this paper is based in large part on an old manuscript by J. M. Coarsey, Jr., G. H. Culpepper, L. F. Lewis, and A. J. Graham, and reports by M. R. Smith and W. G. Bruce of the U. S. Department of Agriculture and E. O. Wilson and J. H. Eads of the Alabama Department of Conservation. Mr. Lewis did most of the work on biology in 1950 and 1951.

OBSERVATIONS ON THE BIOLOGY OF THE IMPORTED FIRE ANT

Prepared in the Insects Affecting Man and Animals
Research Branch, Entomology Research Division

The imported fire ant (*Solenopsis saevissima richteri* Forel) is an annoying and sometimes destructive pest in the Southern States. It stings both man and animals and damages a wide variety of crops. The sting is painful and may fester and persist for several days. It is difficult to hire or retain laborers to harvest crops in infested fields. The ant may also injure or kill newborn birds and small animals. The large mounds that it builds are unsightly and interfere with agricultural operations.

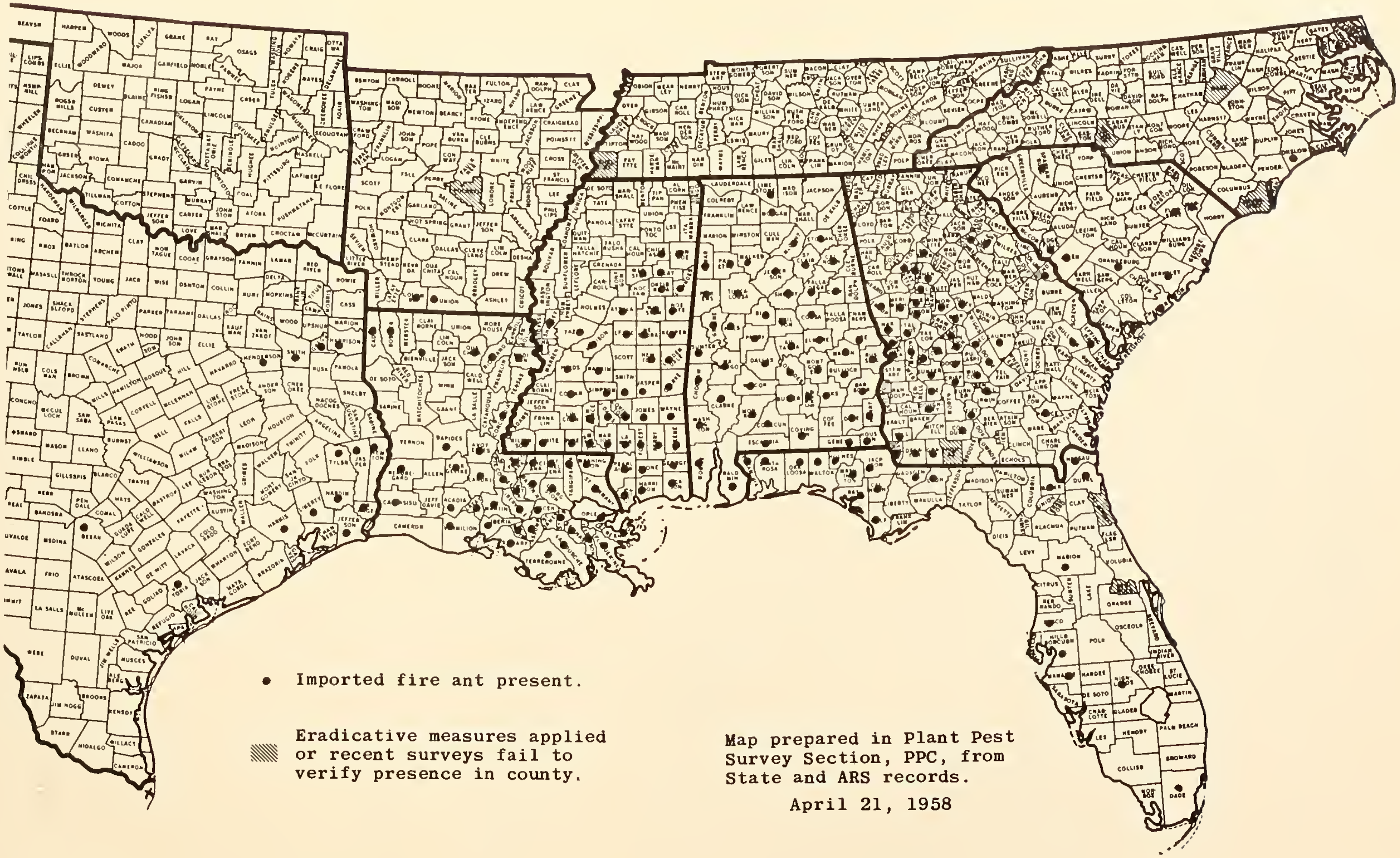
Since the biology of the imported fire ant differs in some respects from that of other ants, it is not possible to base control recommendations on the habits of other species. For example, this ant enters and leaves its mound by underground openings, and digs long tunnels through which it ordinarily moves in foraging or carrying brood to a new location. It shows a remarkable tolerance to flooding and high water, and to a wide range of soil types.

History and Distribution

The imported fire ant was first found in the United States in Alabama in 1929. Creighton (2) reported its presence with the statement: "Three or four years ago I was surprised to find specimens of this insect in material collected at Mobile, Ala. Mr. H. P. Loding, who has made an intensive study of the insects of that region, is of the opinion that its first appearance may be dated about eleven or twelve years ago." Loding (5) was the first to publish information on the occurrence of this ant in the United States. He stated: "This ant [*richteri*] has for several years done considerable damage [in Alabama] to young Satsuma orchards and nursery stock by girdling trees just above the union of stock and graft, evidently to get the oozing sap." It probably came in as a stowaway in cargo or ballast from some South American port, and its close resemblance to some of our native fire ants prevented its detection.

The possibility of its introduction even before 1900 was suggested by interviews with old residents in southern Alabama. For example, a retired seaman in Baldwin County first became familiar with the imported fire ant in South America, in ports where coffee was being loaded. He believed that the ant entered the United States on the dunnage of coffee ships. This matlike dunnage was made in South America from

Distribution of Imported Fire Ant



● Imported fire ant present.

▨ Eradicative measures applied or recent surveys fail to verify presence in county.

Map prepared in Plant Pest Survey Section, PPC, from State and ARS records.

April 21, 1958

native vegetation and stacked out-of-doors on the ground until used. Fire ant colonies occasionally moved into the stacks of mats, which were later loaded onto the coffee ships. Before passage of the Plant Quarantine Act of 1912 it was common practice for dunnage to be dumped overboard after a ship had discharged its cargo and pulled away from its berth. This sailor said he had found fresh mounds of a fire ant in dunnage that had floated ashore from coffee ships in Mobile Bay. He first saw what he believed to be the fire ant in the United States in 1900 along the Bay front in both Mobile and Baldwin Counties.

No specimens from this and other early reports are available for identification, and both in the United States and in South America there are other species or varieties of Solenopsis that closely resemble the imported pest.

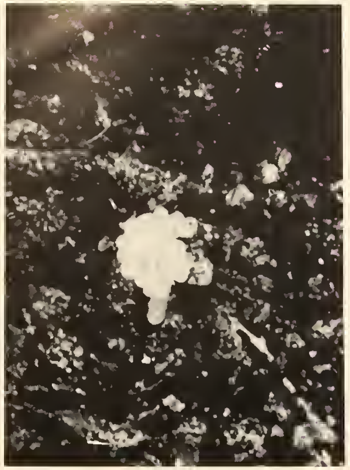
Early in 1958 surveys by the Plant Pest Control Division showed the imported fire ant to be present in nine southern States. In an earlier survey (1953) it occurred in ten States, but it has apparently been eradicated from Tennessee, where it was limited to small, isolated spots. This ant is still a problem in Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, South Carolina, Texas, and limited areas in North Carolina. In these States it has been found in 204 counties (see accompanying map), infesting at least 20 million acres. It has been found as far north as Wake County, North Carolina (36° N latitude), and as far south as Dade County, Florida (25°-26° N latitude). The easternmost record has been Onslow County, North Carolina (between 77th and 78th parallels), and the westernmost, Bexar County, Texas (between 98th and 99th parallels).

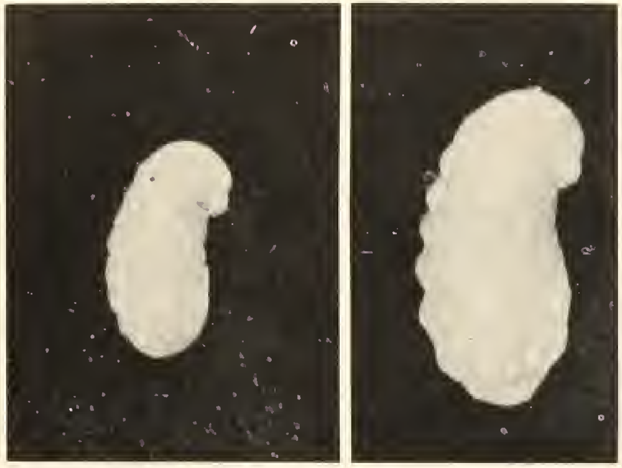
Life History

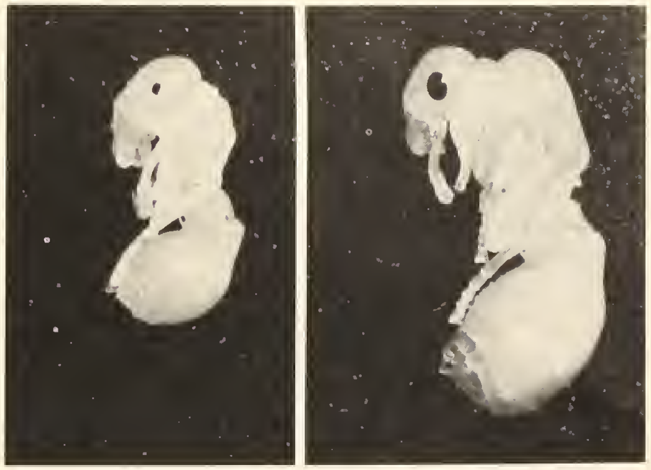
The life history of an animal organism includes the changes through which it passes in its development from an egg until its natural death. This definition is too simple for ants and other social insects, unless the individuals are considered as mere portions of the larger organism consisting of the entire colony. At one stage in the life history of an ant colony there is typically only one ant--the female just after mating.

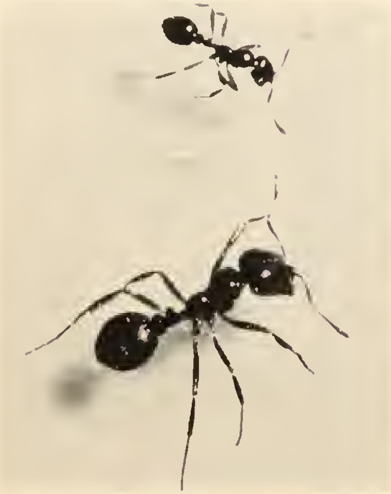
A fire ant colony is started when a young mated queen casts off her wings and establishes herself in a protected crevice, under some object, or, if no such protection can be found, in an excavation of her own making. In bare, open terrain she digs a brood chamber 1 to 4 inches underground. She plugs her entrance tunnel but leaves a visible pile of dirt castings. When the chamber is about 4/5 inch in diameter, she lays her first cluster of eggs, and rears the brood through the larval and pupal stages. The first eggs are usually laid on the day after the mating flight. They are smooth, shiny white, ellipsoidal, and about 350 microns long. They are tended and carried about in the brood chamber almost constantly by

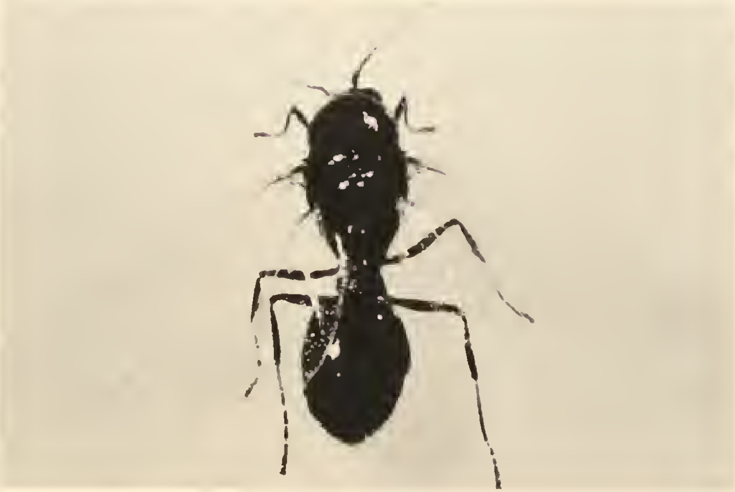
Stages of the Imported Fire Ant

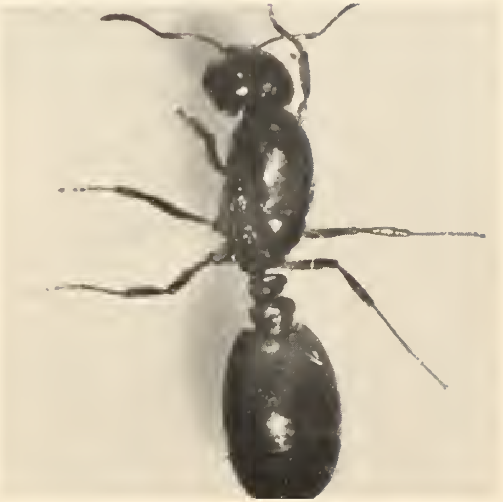

Egg cluster


Larvae; worker left, male or female right


Pupae; worker left, winged female right


Adult workers; minor top, major bottom


Winged male


Queen

the queen. The first cluster contains 10 to 15 eggs, which hatch in about 8 to 10 days, but by the time they hatch she has laid from 75 to 125. She then stops laying until the first brood of workers is reared, in about 2 weeks to a month. Later batches of eggs are cared for entirely by the workers. Enormous numbers of eggs may be found in the top portions of older mounds. To the casual observer they look like finely ground meal.

The larvae are dirty white, legless, and sparsely covered with recurved hairs. As the larvae grow, their body segments and their slightly protruding mouth parts become discernible. They are dependent on other members of the colony for their care, and cannot even move about unassisted. The first larvae are fed by the queen from a reserve food source within her body. The larval stage of the workers usually lasts 6 to 12 days. In the larger mounds the larvae of the males and females can be distinguished. These larvae develop more slowly and in their later stages are conspicuous because they are larger than worker larvae.

The pupae are shiny white, and of about the same size as the adults, which they resemble in shape. They are not enclosed in cocoons, as are some kinds of ant pupae. They gradually darken, and adults emerge in 9 to 16 days. The worker pupae vary in size. Pupae of the sexed forms can be distinguished by the flattened, paddlelike wing pads.

Like the native fire ants, adult workers of the imported fire ant are polymorphic--their size varies within a colony. The first workers, those reared by the queen, may be less than 3 mm. (about 1/8 inch) long, but in the older mounds larger (twice as long) forms are also present. Apparently all workers of this species have the same function--caring for the brood, foraging for food, maintaining and enlarging the colony home, and helping to protect the colony from enemies. With some species the newly emerged adults care for the brood, and foraging and mound maintenance are the functions of the older ants. This may also be true of the imported fire ant.

Many kinds of ants have a special caste of warriors, or soldiers, especially adapted for protecting the colony by their more robust bodies and larger mandibles. The heads of such soldiers are often very large, all out of proportion to the rest of their bodies. The larger workers (majors) of an imported fire ant colony are more able fighters but do not have enlarged heads, and the distinction between them and the smaller workers (minors) is less marked. Since they are larger, their mandibles are more powerful. The majors may have more of the irritating fluid in their stingers, but their stings are not appreciably more painful than those of the smallest ants.

In the older, populous colonies along the gulf coast, sexually mature winged ants may be found at almost any time of the year. They usually overwinter in the colonies, and make the mating flights in the spring

Following these flights there are few winged forms in the mounds, for a brief period at least.

According to Green (3), whose work was done near Starkville, Miss., the first eggs of the year in large colonies are laid in March. These eggs develop into winged males and females only, and not until several weeks later are the worker broods started. The only pupae he found before April were those of winged forms. About 70 percent of the pupae found in April were winged, and the remainder were workers. By early June over 90 percent of the pupae were workers, and by mid-November the only pupae found were workers.

This biology is probably typical for climates similar to that of Starkville, but the Department observers were near Mobile, Ala., where winters normally are milder. Here brood rearing continued during the mild winter of 1949-50, but not during the severe winter of 1950-51. One flight was observed in December, but this and other pre-April flights presumably were made by overwintering ants.

Sexual forms are rarely seen in the open except at the time of the mating flight, which often occurs after a rain. The workers open the mound in several places and can be seen running over the surface and on nearby vegetation. From time to time winged ants come out of the openings, sometimes a dozen or more at a time. The males are smaller than the females. Males often take to flight directly from the mound surface, whereas the females generally climb on the nearby vegetation to get a better position from which to lift their heavy bodies on their one and only flight. After fertilization the queens shed their wings, for which they have no further use, and begin locating and building the brood chamber. The males do not return to the parental or any other colony, and die in a day or two.

Flights may be general--from practically every mature mound in a large area at the same time--or from only a few mounds in a small locality.

The first flight observed by Department entomologists was near the Spring Hill, Ala., laboratory on December 27, 1949. Following this flight, which was a general one, de-alate queens (those that had shed their wings) were found wandering over the ground. They were also found on the surface in January, February, and early March, though no flights were observed. On March 16 de-alate queens were found under rocks, boards, and other cover. It is not known when their flight occurred if it did occur, but the next day a minor flight was observed 5 miles away at Mobile's municipal airport, where winged forms were seen leaving about a third of the mounds.

On the 12th of April, 33 de-alate queens were picked up on an area about 60 feet square near the laboratory, again without an observed flight. Minor flights were seen in various localities near Mobile on April 13 and 17, but at no time was flight observed from most of the mounds in any locality.

The first general flight observed in 1950 was on April 26; others were seen on May 15 and 22. The flights took place over a wide area, and every mature colony seemed to release tremendous numbers of winged forms in a very short time. On April 26 about 3,000 sexed forms appeared in 15 minutes from a single mound that was under observation.

During these general flights and for a short time afterwards, as many as six de-alate queens per square yard could be seen. After every flight many mounds were examined, and all mature colonies still had large numbers of winged forms. Between these general flights minor local flights were seen, and they continued long after the general flights.

In some mounds only males or only females were present, in addition to workers and queens, but usually both sexes were found in about equal numbers, as expected. The reason for finding one sex alone is not known. In some insects--honey bees, for example--such a phenomenon is evidence of parthenogenetic reproduction, as would occur if an unmated queen or worker began laying viable eggs. In the honey bee such parthenogenesis results in the production of males, but this may not be true in ants.

Color Variations

Although the color of the major (larger) workers is fairly constant within a colony, it varies from mound to mound. In some colonies they are piceous brown or nearly black, with a broad orange band on the dorsum of the first gastric segment. In others the general appearance is lighter, with yellowish brown on the head and at least the posterior border of the first gastric segment. Within a colony workers of different sizes may differ in color. Minor (smaller) workers are often not marked like major workers in the same colony. In light colonies they seldom show a band on the first gastric segment; in dark colonies the band may or may not be present on the minors but it is always present on the major workers.

The appendages are reddish brown in all adults, but slightly darker in the darker form. Queens are similar in color to the major workers of a colony, but the males are uniformly black. Taxonomists consider the darker form as typical and the lighter one atypical. However, the atypical form is apparently more common in the United States. These light-colored ants show more vigor and have spread faster and farther.

The reason for the two distinct color forms is not known, although several theories have been suggested. They may be different strains that were introduced separately, or one form may have developed after introduction of the other. The darker form was the first one found in the United States, but it may not have been the first to arrive on our shores.

Studies by Department entomologists in 1950 led to a tentative hypothesis that environment coupled with the age of the colony determines the color of the ants. Hundreds of mounds in every type of soil and habitat in Mobile County were examined. All colonies seemed to be light in color when small, and to remain so unless they established themselves in damp situations, where they eventually became dark. Practically all dark colonies were in very damp environments, and all of them were mature and contained winged forms. It was not unusual to find young colonies around the dark colonies, but all young colonies were light regardless of their environment. There were very few dark colonies on land with enough drainage to permit cultivation, but occasionally one was found that could be traced to a nearby damp environment.

An observation that lent support to the hypothesis that color depends on the environment and colony age was one made along a highway and in a surrounding marshy area--practically a tidewater flat. No young colonies could be found on the flat, a habitat believed too damp for new queens to establish brood chambers. Nearly all the large mounds and all the young colonies found on the highway shoulders (dry situation) were of the light form. Large colonies moved out from road shoulders onto the flat, built mounds there, and seemed to thrive despite the extreme dampness. Colonies on the damp flat moved from time to time, as noted by the abandoned mounds. It seemed logical that those colonies farthest from the highway (about 75 yards) had been there the longest, and examination revealed that all of them were dark. A few colonies on the flat within about 30 feet of the road were of the light form. Some of them had obviously just moved from the road shoulder. Similar situations elsewhere in southern Alabama showed a similar fire ant picture.

That the typical, dark form was the first richteri to be observed may possibly be due to the conspicuousness of the large mounds they build in damp coastal situations. When one enters a field containing hundreds of imported fire ant mounds, invariably those of the dark form are the first to catch the eye. These mounds draw attention away from the smaller mounds inhabited by the light-colored ants. Also the lighter ants closely resemble the dark forms of Solenopsis xyloni McCook, one of the native fire ants. Light-colored richteri and dark xyloni ants cannot be distinguished in the field, even by one having a good knowledge of ants. Therefore, one not aware of the presence of more than one color form in richteri could easily ignore the light form if he had already collected samples of xyloni.

Wilson (9, 10, 11) suggested that the presence of the two color forms of richteri indicates either mutation of the original United States population, which he presumes was the dark form, or a second introduction. Since he found the light forms of this species in South America concentrated in the subtropical savannah and the dark forms in the more arid pampas, he was unable to explain the fact that in the United States "in the face of competition from the light phase it /the dark form/ should survive longest in low, swampy areas." He concluded that "Perhaps we shall find that temperature is actually the principal physical selective agent involved."

Since high temperatures (discussed under Effects of Temperature) adversely affect imported fire ants living in dry soils, Wilson's conclusion on temperature may be valid. Lower temperatures in mounds in damp locations in the United States may be the principal environmental factor in the production of the dark ants, if the environment-age hypothesis is correct. As to whether there were separate introductions of the two color extremes, it would seem equally likely that a group of intermediates introduced first could quickly produce the extremes, if genetically related.

Department entomologists found that in areas where both color forms were present nuptial flights occurred simultaneously. Whether the two forms interbreed can only be determined by cross-breeding experiments.

Mound Construction

Although one queen usually constructs the brood chamber, occasionally several queens are found together. Sometimes the brood chamber is excavated in the soil under a stone, board, piece of tin, or similar object, but more often it is in the open. As soon as the first workers emerge as adults, they begin to enlarge the underground chamber, piling the earth in a dome-shaped mound over it. The mound increases in size as the colony grows. The workers soon take over the entire care of the colony, except egg production, which is a function of the queen.

Mounds are found in various types of soil, ranging from loose sands to the heavy compacted clays. They occur very near the Gulf shore in soil poor in organic matter, and also in the rich alluvial river valleys. Drainage does not seem important to mature colonies, and they nest in low areas subject to occasional submergence as well as in very dry soils.

The size of the mounds depends on the location, climate, and number of ants in the colony, but they average about 15 inches in diameter and 10 inches in height. In low marshy terrain they may be 3 or more feet high, and some of the larger mounds are 3 to $3\frac{1}{2}$ feet in diameter. In the summer of 1950 the ants did not maintain mounds in dry situations during the hot months, but as soon as rains and cooler weather returned, the mounds became noticeable. On one occasion reapperance of the mounds revealed a lack of control where insecticides had been given credit for eliminating the ants. Sometimes the weather or location is more important in governing mound size than the age of the colony.

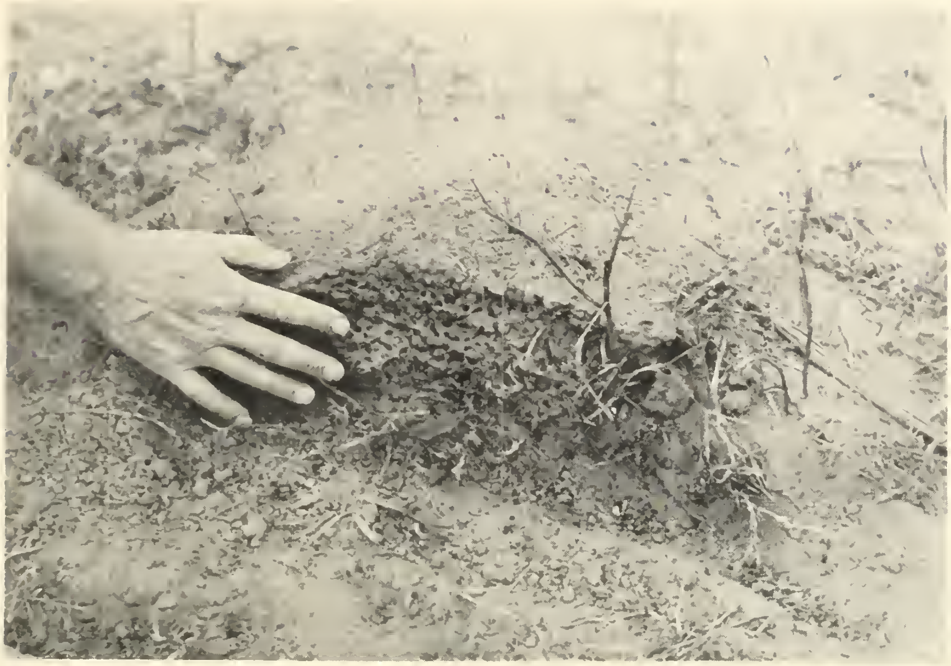
In heavy soils the mound is covered with a hard crust and the interior, both above and below ground is of a firm honeycombed construction. Some of the smaller galleries are barely large enough for the ants to pass, but many are as much as 1 1/4 inches in diameter. In sandy, loose soils the mounds are more flattened and the honeycombing may not be apparent when they are opened.

Most of the subterranean galleries are excavated within a cone, the point of which may be 3 feet below the surface. This cone, together with the above-ground portion of the mound, contains most of the colony. A few vertical tunnels have been found dug to depths of 5 feet or more, especially on slopes and well-drained locations.

Most mounds have no visible entrance or exit. While excavating, generally at night or after a rain, the workers open numerous holes, around which they pile the earth. Exit holes are also made when the sexual forms are ready to take their mating flight. The workers promptly close all holes after use. They leave and return to the mounds just below the soil surface through lateral tunnels, the openings of which are at various distances from the mounds; they have been found as far as 132 feet. Portions of the tunnel roofs occasionally collapse, leaving irregular trench-like depressions through which the ants pass.

A fire ant mound in compact soil

The ants usually build mounds where direct sunlight strikes them at some time in the day. Although they are occasionally found in woods, they are more numerous in fields and clearings. However, sunlight seems to be much less important than food supply. Colonies are commonly found in rotting logs, around



A mound cut away to show honeycombed interior

pine stumps, and at the base of trees. The ants have been observed to build colonies under various types of foundations, thus weakening them. They have also been found in termite galleries, in logs, stumps, and in a house.

Colony Movement

Mounds in a favorable position may remain occupied for a long time, but as they become older and larger it is more difficult for the workers to maintain them. Presumably both sanitation and structural repairs are involved. Abandoned mounds may be found in any heavily infested area. New mounds are bright with fresh earth; old mounds are darker, particularly when abandoned.

Large colonies have the advantage competitively, and starve out the weaker colonies. A heavy population in the area, particularly where there are 25 or more mounds per acre, undoubtedly causes some of the ants to seek another location. Over 100 mounds per acre have been observed in some pastures during the fall or early winter months. However, as winter advances food in most places becomes scarcer and the number of colonies per acre decreases. Sometimes the workers will locate a new source of food, or a slight external disturbance to the mound may cause a colony to move.

A colony may start construction on several sites before it settles on one spot. The move may be as far as 30 feet, or no more than 3 feet. The ants may utilize deserted mounds of other fire ants, or elevations such as compost piles and roadside embankements. Location on high ground is a tremendous advantage to a colony in areas subject to periodic flooding.

The workers rarely carry eggs and young across areas exposed to the sun, although occasionally colony movement may be observed when the lateral tunnels are partly exposed or have collapsed. Most of the colony goes to the new location, but a few workers may remain behind in the old mound until they die.

Food

Near the gulf coast the primary factor in the ants' ecology seems to be food supply. The ants feed on many kinds of plants (see Destructive and Annoying Habits). They also feed on other insects. In open grassy places insects are important food. Where the soil is poor and there is only a sparse growth of nonsucculent vegetation, few insects are present and the population of fire ants may be small. More colonies per acre will be found where soil fertility is high, apparently because such ground supports a greater amount of food materials, both plant and animal.

The ants also feed on honeydew obtained from aphids, scale insects, and mealybugs. Like our native fire ants, they are very fond of some seeds and will gather both wild and cultivated seeds for food. They attack growing plants as well, macerating the tissue and sucking the exuding fluids. They also attack hatching bird eggs and newborn wild and domestic animals, especially ground-nesting game birds, poultry, rabbits, squirrels, pigs, and calves. The ants do not swallow solid food but they extract liquid from the macerated tissues.

Although primarily outdoor ants, they sometimes invade homes, where they feed on any food of high protein content, especially meats. In the laboratory, when they were offered various human foods, the ants showed a preference for lean meats, liver, boiled eggs, cheese, peanut butter, and also honey and vanilla wafers, but little interest in lard, sugar, raisins, carrots, and tomatoes, and none in squash, orange peel, and unsoaked garden seeds. Butter was acceptable.

Effect of Temperature

Some observations were made from time to time on the effects of temperature on the fire ant in the field. There was no visible activity outside the mounds when the air temperature fell below 40° F. or rose above 90° in the shade. In dry, sandy soil in open sunlight at the latter temperature the ants stopped all work on their mounds and retreated about 4 inches below the ground. During prolonged periods at this high temperature there appeared to be little maintenance in the upper half of the colony and the mounds nearly disappeared. When the ants were disturbed, they did not swarm out with their characteristic viciousness. However, in the shade or in low, damp situations activity was normal. Even in mounds exposed to direct sunlight activity was normal at warm temperatures below 90°.

During the hot summer months in Mobile County in 1950, in dry soil the mounds were inconspicuous and at times difficult to find. The ants with their brood withdrew into the ground, even below the moisture line. When the air temperature approached 95° F. in the shade, the ants of a colony located in direct sunlight could be induced to emerge from the mound only after vigorous disturbance, and they would stay out but a short time. Throughout the summer, even in dense shade, very little mound buildup could be found except immediately following rains or on cool, cloudy days. In wet situations, however, where a mound served to protect the colony from excessive moisture, mound building and maintance continued without interruption, even on the hottest days.

During the week of September 3 the air temperature dropped to an unseasonable 70° F. and lower for several days. Imported fire ant mounds suddenly appeared on plots of ground in Mobile's Pine Crest Cemetery, where none had been visible during five or six previous surveys. It was assumed that the colonies had been present during the hot period, but mound building had ceased. It is not believed that the ants estivate, however, for when mounds did appear they contained the normal complement of brood in all stages of development. Egg laying and brood rearing must have proceeded at about the normal level. Furthermore, on cool days and in shady places during the hot days the foraging workers were found in abundance.

During several days of freezing temperatures (daily minima 22°-32° F.) in the fall of 1950, the ants inside the mounds were completely inactivated. They were clustered in the small passageways below the ground level. They did not congregate in one large mass, or assemble their brood in one location, but were fairly evenly distributed throughout a depth of 2 feet or more. After the temperature moderated (above 40°), the ants resumed their normal activities, and there were no visible ill effects on either the adult workers or sexed forms of the brood.

Rate of Spread

In 1953 the imported fire ant was estimated to have a natural rate of spread of 3 to 5 miles per year. As it moved into an area, it apparently displaced the native fire ants, Solenopsis xyloni McCook and geminata (F.). Such displacement was noted in the vicinity of Monroeville, Ala., which was then the northeastern fringe of the continuously infested area radiating from Mobile. Since the spread was apparently slow and mostly to the north, northeast, and east--the direction of prevailing winds--it was believed to be dominated by wind currents while the sexual forms were in flight. By 1957 there was a heavy population more than 100 miles east and about 140 miles north of Monroeville. This indicates that the ants may at times have a much faster rate of spread. It is not known how much of this spread is by flight and wind and how much is due to transportation by rail, automobile, or even airplane, either in infested materials or as hitchhikers.

As mentioned under Life History, de-alate queens may be found in large numbers following mating flights. They are noted wandering on the ground and under almost any object on the ground. Spread by hitchhiking could readily occur following these flights. As de-alate queens are supposed to have mated, the mating flights may also be considered dispersal flights. Hitchhiking was shown to be important in the early spread of this ant along roads and railroads in Alabama.

Young queens and small colonies can be moved in nursery stock. The ants often build mounds in nurseries, especially among heeled-in azaleas, camellias, and similar plants. Movement of infested soil on nursery stock or soil transported for any purpose may be an important means of spreading the ants.

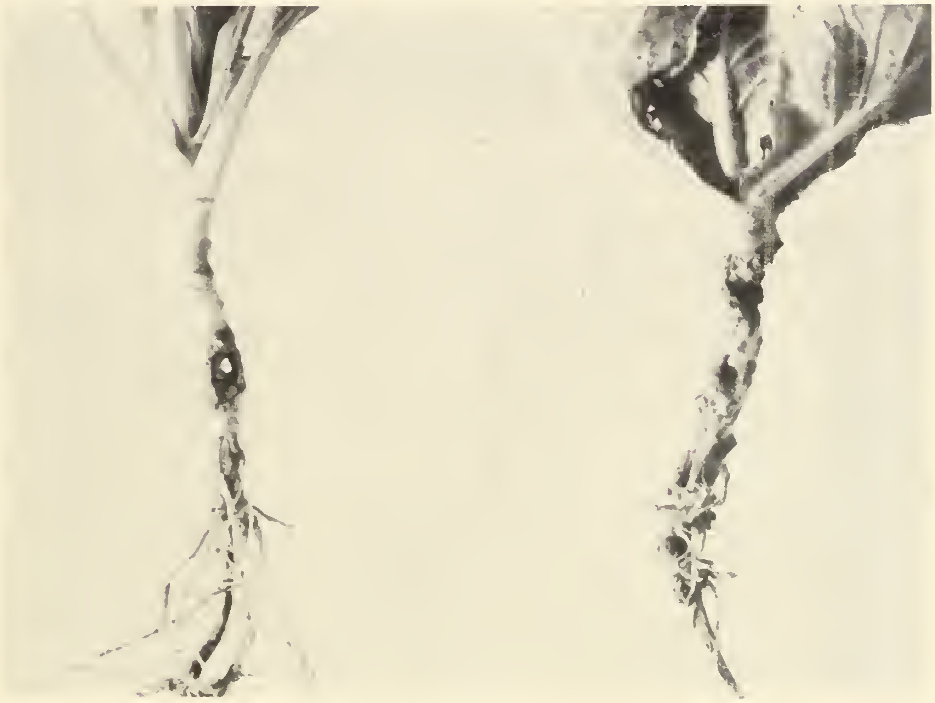
Survey personnel found nursery inspection to be a quick means of establishing the distribution of the fire ants. Much time is required to find mounds in the unlimited acreages of cultivated and uncultivated land unless the population is fairly high. This is especially true in the summer, when vegetation may obscure some colonies or high temperatures may prevent mound maintenance. Infestations far removed from the major ant population may have been carried in infested soils, logs, stumps, and other materials, or by hitchhiking mated queens.

Destructive and Annoying Habits

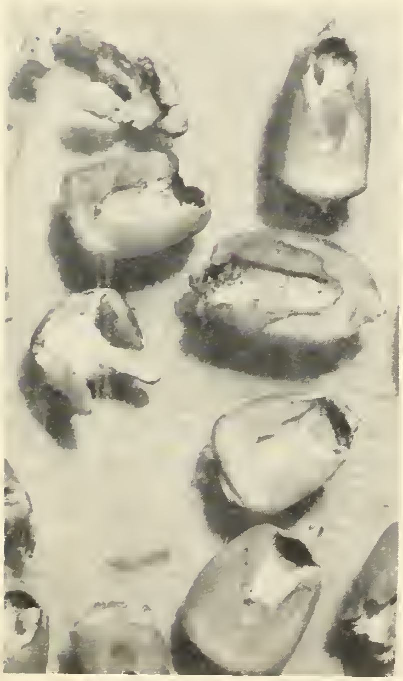
The imported fire ant is a nuisance to man and animals because of its stings. It is also destructive to plants, attacking young cabbage, collards, eggplant, potato, and many other plants. It macerates the tender stems just below ground level and feeds on the juices. It is particularly fond of okra seedlings and also attacks the flowers and pods. It will girdle young citrus trees at the bud union to feed on the sap, and eventually kill the trees. Individual plants, especially low-growing types such as strawberries, are often buried in the mounds. The ants may destroy germinating seed corn and injure the young plants. In one farm in Alabama the ants destroyed at least 85 percent of the germinating seed on 35 acres of white field corn and the field had to be replanted. An adjacent field of yellow hybrid field corn was untouched by the ants. White field corn planted in the garden at the laboratory was not bothered by the ants, but they damaged leaves and stalks of young sweet corn. The fire ants chewed off practically all the potato vines in the garden and subsequently attacked bunch beans.

In hay fields the mounds themselves are a problem. When they are numerous sizeable amounts of hay and grazing are lost from pasture use. The blades of harvesting machinery are often broken when they strike one of the hardened mounds. The mounds are equally damaging to mowing equipment along roads and highways.

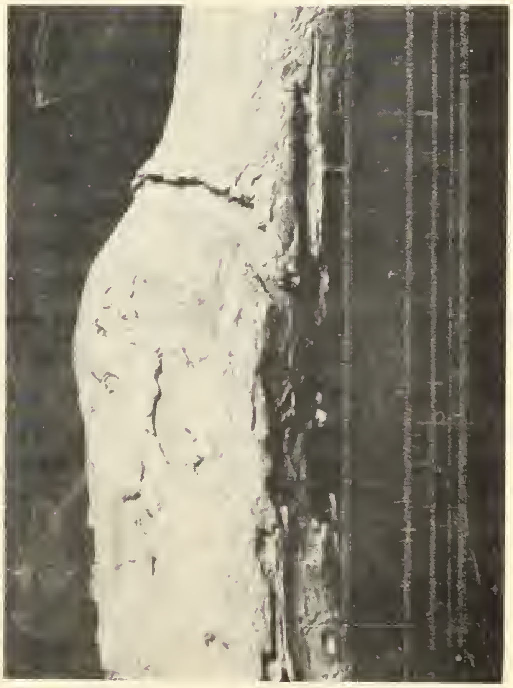
Damage to Plants Caused by the Imported Fire Ant



Cabbage stems



Germinating seed corn



Young citrus killed by girdling at bud union

The large mounds mar the beauty of city parks and lawns, but, even more important, children who unknowingly walk into them will be severly stung. On the gulf coast only small children make this mistake; older children have learned to stay away from the mounds. Annoyance from fire ants in cemeteries is common in this area. Mounds are often built adjacent to tombstones, and a slight disturbance usually brings forth a multitude of the ants. The ant also viciously stings laborers harvesting crops, so that it is difficult to retain them on the job.

A fire ant will bite and attempt to sting any animate object with which it comes in contact. The bite is quickly followed by a doubling under of the ant's abdomen as it inserts its stinger.

The painful sting accounts for the name "fire ant," though a single sting is less painful and not so long-lasting as that of some of the larger harvester ants. The spot stung by the fire ant first swells into a wheal; then a blister appears, and it is soon filled with pus. According to Jung and Derbes (4) and Caro et al. (1), pustulation is not evidence of secondary infection, since the pustules are usually sterile. They found the poison to be a powerful necrotizing agent, with necrosis at considerable depth beneath the pustule. Occasionally the victim developed severe reactions requiring the aid of a physician. These workers report that antibiotics and antihistamines are valueless in treatment and do not alter the development of the lesions following the sting.

There are no published papers on imported fire ants as destroyers of birds and animals, but Travis (6, 7, and 8) has discussed the destruction of quail by the less populous native fire ants. He points out that the quail nests destroyed, at least in part, have been estimated as high as 16 percent. The extent of fire ant damage to quail can only be determined by keeping large numbers of nesting birds under close observation. However, on July 18, 1951, a quail nest attacked by imported fire ants was observed by a Department worker in Mobile County just as the quail were hatching. Four quail chicks, which had pipped their shells only, were destroyed by the invading fire ants. However, 9 chicks which had hatched and dried before the ants appeared were uninjured.

When imported fire ants enter dwellings, they sometimes damage clothing while feeding on the soiled places.

The fire ants' habit of tending aphids, scale insects, and mealybugs may also prove destructive, since the ants frequently protect these plant-feeding insects from their parasites and predators.

Relationships with Other Arthropods

On cultivated land that was kept unplanted for a considerable time, colonies of imported fire ants were observed in fierce battles. On one plot of infertile ground 185 young colonies per acre were counted in May 1950, but by December the number had dwindled to 8. Where food is scarce competition may drive many colonies out of an area. It is not known whether small colonies sometimes combine.

Department entomologists never found the imported fire ant to be aggressive against any other species of ant. Its displacement of native fire ants may have been due to competition for food.

According to Wilson (9), Loding said that the Argentine ant (Iridomyrmex humilis Mayr) displaced the imported fire ant around Mobile when it invaded the fire ant territory. However, it is believed that the Argentine ant reached our shores much earlier than the imported fire ant--that it invaded New Orleans before 1891. In 1950 both species were found in almost every block in Mobile and every other place where the imported fire ant was prevalent. If the Argentine ant were firmly entrenched over the area before the fire ant came to the United States, it would appear to have no real ability to exclude the fire ant from any area that is otherwise suitable for it.

Argentine ants are very aggressive and sometimes attack large fire ant colonies, but generally without noticeable success. One such attack was observed which began in the afternoon of May 23, 1950. No imported fire ants were in the open when the attack began, but when the mound was disturbed they started to swarm out in characteristic fashion. When they encountered Argentine ants, most of the fire ants withdrew into the mound, and those that remained outside depressed the anterior portions of their bodies and elevated the posterior portions almost vertically, while pulsating their abdomens with quick, rhythmical movement. This position is quite different from the one taken in stinging. The Argentine ants darted about with their characteristic quickness, running up to and retreating from the fire ants. Evidently the fire ants were emitting an irritating substance from their abdomens, for occasionally an Argentine ant went into a convulsive fit, contorting its body or retreating with no apparent regard for direction. The irritating material could not be seen, apparently being either finely atomized or gaseous. The fire ants themselves shook their heads and antennae and tried to bury their heads, as if the substance were irritating to them too. After they had held their abdomens erect for 15 to 20 minutes, they fell over as though completely exhausted and lay still. The Argentine ants continued to dart at the fire ants. Several times a fire ant was grasped, but generally it quickly twisted around and slapped the end of its abdomen against the Argentine ant. This maneuver caused the attacker to go into an even more violent convulsion. Occasionally, however, an Argentine ant succeeded in grasping an exhausted fire ant by the head and moved off with its victim.

This strange battle went on until about noon of the following day, when the Argentine ants withdrew. The mound was checked once or twice daily, but no more Argentine ants were seen around it, and the activity of the fire ant colony apparently returned to normal.

A yellow lion ant, *Dorymyrmex pyramicus flavus* McCook, competes successfully with the imported fire ant. The lion ants occasionally deposit dead fire ants outside at the base of their small craterlike mounds, which are commonly found along with those of the fire ant. Combat between this ant and *richerti* has not been reported, but Travis (8) noted it with *geminata*. *S. geminata* showed the same defensive tactics against this ant as *richteri* showed against Argentine ants.

The Florida harvester ant (*Pogonomyrmex badius* (Latr.)), with its large, flat mound frequently covered with bits of charcoal, is able to carry on its activities in the presence of the fire ant. Travis found that this ant easily subdued *geminata*.

A light-tan legionary ant, *Neivamyrmex opacithorax* (Emery), was once found in a mound of the imported fire ant. Legionary ants go out in swarms while foraging for food, and probably prey on the fire ants from time to time.

In Mobile small colonies of *Pheidole moerens* Wheeler live under boards or bricks close to the imported fire ants, and they apparently thrive together.

Along the gulf coast the periphery of the fire ant mound is sometimes occupied by a species of *Brachymyrmex*. This is a honey ant which, when engorged with food, has a large, translucent abdomen. It has only been observed in fire ant mounds in which the colony was not at full vigor. In another part of the mound may sometimes be found *Cyphomyrmex rimosus* (Spinola), a medium-sized, blackish, angular-headed ant, which is known to thrive on a fungus that grows on organic wastes. It is often found in abandoned mounds.

Imported fire ants protect many important insect pests. They tend aphids, scale insects, and mealybugs, feeding on the honeydew discharged by these insects. They sometimes erect shelters of soil pellets around stems or low branches infested with these plant-feeding insects, thus preventing parasites and predators from holding the populations in check. The ants make a frenzied attack on anything or anybody that approaches the aphids they are tending. They have been observed hanging to plants with their hind legs, stretching out pugnaciously towards anything in their vicinity. The following species have been observed being protected in this manner:

Anuraphis maidi-radicis (Forbes), the corn root aphid
Aphis gossypii Glov., the cotton or melon aphid
A. maidis Fitch, a corn aphid

Cinara tujafilina (Del. G.), an arborvitae aphid
Coccus hesperidum L., the soft scale
Eriococcus azaleae Comst., the azalea bark scale
Myzus persicae (Sulz.), the green peach aphid
Protopulvinaria pyriformis (Ckll.), the pyriform scale
Pseudococcus sp., a mealybug
Saissetia nigra (Neitn.), a scale
Stictocephala sp., a treehopper nymph
Toumeyella parvicorne (Ckll.), a pine scale

The imported fire ant has been observed to attack certain other insects, including the following species:

Anthonomus grandis Boh., the boll weevil
Carneocephala sp., a leafhopper
Datana integerrima G. & R., the walnut caterpillar
Euxesta sp., an otitid fly
Ips avulsus (Eichh.), a pine beetle
Laphygma frugiperda (J. E. Smith), the fall armyworm
Neoconocephalus triops (L.), a grasshopper
Pantamorus godmani (Crotch), the Fuller rose beetle
Phyllophaga micans (Koch), a June beetle
Renia discoloralis (Gn.), a measuring-worm moth
Reticulotermes flaviceps (Kollar) [presumably], the eastern subterranean termite

This habit of attacking harmful insects is of doubtful benefit in the United States, however, since their normal populations have not been greatly reduced even in areas where the fire ant is abundant.

Small red mites of the genus *Urodinychus* are occasionally seen riding on the bodies of imported fire ants. They appear to be well tolerated and do not seem to affect the ants. They have not been found within the mounds in any great numbers.

Once an ant mound has been firmly constructed in heavy soil, it may take many years for the forces of weathering to return it to ground level. Abandoned mounds are utilized by various arthropods, including several other species of ants as well as centipedes, springtails, and wireworms.

Summary

The imported fire ant (*Solenopsis saevissima richteri* Forel) is an annoying and destructive pest in the Southern States. It stings man and animals and damages a wide variety of crops. The large mounds it builds to house the colonies are unsightly and interfere with agricultural operations. This ant was first found in the vicinity of Mobile, Ala. It is believed to have entered in cargo or ballast from some South American port.

Along the gulf coast winged fire ants may be found almost any time of year. They usually make their mating flights in the spring, either from a few mounds or more generally. A newly mated queen digs a small brood chamber, lays a few eggs, and rears the first brood; subsequent broods are reared by the workers. Eggs hatch in 8 to 10 days, the larval stage lasts 6 to 12 days, and the pupal stage 9 to 16 days. The workers construct the mound, guard the colony, and forage for food. Except during excavation or mating flights, there are no visible openings in the mound; workers enter and leave by underground tunnels, the openings of which are some distance away.

Mounds are built in various types of soil, both dry and wet. On low ground they are conspicuous and firmly constructed. In loose, sandy soils they sometimes disappear in hot weather, when the ants do little or no maintenance work.

This fire ant attacks various kinds of insects, but with little reduction in their numbers. It also feeds on honeydew from several insects. Argentine ants sometimes attack imported fire ant colonies, but usually without success.

Literature Cited

(1) Caro, M. R., Derbes, V. J., and Jung, R.
1957. Skin responses to the sting of the imported fire ant (Solenopsis saevissima). A. M. A. Arch. Derm. 75(4): 475-488.

(2) Creighton, W. S.
1930. The New World species of the genus Solenopsis (Hymenoptera, Formicidae). Proc. Amer. Acad. Arts and Sci. 66: 39-151.

(3) Green, H. B.
1952. Biology and control of the imported fire ant in Mississippi. Jour. Econ. Ent. 45: 593-597.

(4) Jung, R. C., and Derbes, V. J.
1957. The imported fire ant, Solenopsis saevissima var. richteri, an agent of disease. Amer. Jour. Trop. Med. and Hyg. 6(2): 372-373.

(5) Loding, H. P.
1929. (an observation dated July 15, Alabama) U. S. Dept. Agr., Insect Pest Survey Bul. 9, p. 241.

(6) Travis, Bernard V.
1938. Fire ant problems in the Southeast with special reference to quail. 3rd Natl. Amer. Wildlife Conf. Trans., pp. 705-708.

(7) ________________
1939. The fire ant (*Solenopsis* spp.) as a pest of quail. Jour. Econ. Ent. 31: 649.

(8) ________________
1941. Notes on the biology of the fire ant *Solenopsis geminata* (F.) in Florida and Georgia. Fla. Ent. 24: 15-22.

(9) Wilson, Edward O.
1951. Variation and adaptation in the imported fire ant. Evolution 5: 68-79.

(10) ________________
1952. O complexo *Solenopsis saevissima* na America do Sul (Hymenoptera: Formicidae). . Inst. Oswaldo Cruz Mem. 50: 49-68. (Includes English translation.)

(11) ________________
1953. Origin of the variation in the imported fire ant. Evolution 7: 262-263.

Agriculture-Washington

. S. DEPT. OF AGR. LIBRARY
ELTSVILLE BR.
LIBRARIAN
0-24-55 PLANT INDUSTRY STA.
3 BELTSVILLE, MD.